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are indicated, and in the region of the hind brain four well-marked neuromeres exist. External to the 2d, 3d, and 4th neuromeres is an extensive auditory plate, already slightly grooved. There are seventeen somites, which, in the middle region of the trunk, possess distinct cavities, and externally to these from the 4th to the 17th, are situated the beginnings of the Wolffian bodies. At the 7th somite the Wolffian duct is first seen, the appearance of which in sections suggests an ectodermal origin. Double heart origins are present, but there is no trace of a vascular area besides a slight mottling in and around the area pellucida. A distinct blastopore is present with a neurenteric canal, which runs through the head process and opens into the archenteron (yolk-sac cavity). The primitive streak extends behind the blastopore to a distance of 1.5 mm. The embryo more nearly resembles that of the Virginia opossum (*Didelphys*) of 73 hours described by Selenka, than any other embryo known to the authors. The *Platypus* embryo is, however, much longer.—Zool. Anzeiger, 1895, p. 31. K.

ANTHROPOLOGY.¹

The Antiquity of Man in North America.—The problem of the antiquity of man on this continent has received some interesting contributions within the last few years, and it will be interesting to take a survey of its present condition.

The sources of information respecting the first human inhabitants of a country are four-fold—two-fold as to materials, and two-fold as to localities. The materials may be either his bones or his handiwork; the localities are deposits which are either within caves or outside of caves. The bones of primitive man have shown that there was, in Europe, and possibly in Asia (Java), a species of the Genus *Homo* distinct from the *H. sapiens*, which has been called *H. neanderthalensis*. This being possessed all the characters of the skeleton, dentition, etc., which belong

¹ This department is edited by H. C. Mercer, University of Pennsylvania.

to the lowest existing races of men, and had, in addition, a transverse ridge across the inner side of the symphysis of the lower jaw above the genioglossal tuberosity, from which it is separated by a deep transverse valley. Nothing like this occurs in any existing race of the *Homo sapiens*. If any person is disposed to dispute the claim of the *Homo neanderthalensis* to recognition as a species, let him reflect that the diversities presented by the existing races of the *Homo sapiens* are, in some instances, of the kind regarded in zoology as both specific and even generic, and that they are not so regarded is because of the existence of numerous intermediate forms. The peculiarities presented by the Neanderthal man (including, in this term, the people of Spy, Naulette, Shipka, etc.), found in a few of the lowest races are the small cranial capacity, the larger size and quadrituberculy of the last superior molar, etc., while the conformation of the symphysis is not seen in any of them, and is of such a character as to indicate wide divergence in zoological affinity. His small cranial capacity has been shown by Virchow to be matched by that of a Nigrito of the Andamans, where it is as low as 950 ccm., an inhabitant of New Britain, 860 ccm.; Nilgiri, India, 960 ccm.; New Ireland, 970 ccm., and of Abyssinia 975 ccm. No trace of the skeleton of the Neanderthal man has been found in North America. The skull found in the Gold Bearing Gravel of Calaveras Co., California, was without lower jaw, so that its specific position cannot be determined. The cranium proper, however, does not resemble that of the older species. The same is true of the man of Sarasota Bay, Florida; and the man of the baths of Peñon near the city of Mexico had the usual type of lower jaw. For the present, then, this species of man may be left out of account in the present discussion.

Whether, after the subtraction of the Neanderthal species, the history of *Homo sapiens* can be divided into a paleolithic and a neolithic age, or whether the Neanderthal man was the only paleolithic man, remains for consideration. The man who made the turtle-backs of the gravels of the valleys of the Thames and of the Somme, is supposed to be truly paleolithic. Mr. Boyd Dawkins finds, however, that their bone fishing-spears are identical in character with those made and used by the (Esquimaux) Inuit, and he suggests that, in the glacial period, these people existed in southern Europe with the reindeer and other arctic mammals appropriate to the climate. And now comes Mr. Frank Cushing, who declares that not only the spears, but all the other bone instruments and implements of reindeer-horn and bone found in the

² Verhandlungen d. Berliner Anthropol. Gessellsch., 1894, p. 506.

French caves, and supposed to be of paleolithic age, are now in actual use among the Inuit of the Arctic regions of America. The coincidence covers so many kinds of implements, and the appropriateness of the environment is so plain, that the conclusion is almost irresistible, that the river valley paleolithic people were, as Boyd Dawkins supposed, Inuit. But no crania or jaws of these people have been discovered, so that it is not known whether they possessed the dental characters which I have shown to characterize this race.³ It would be remarkable for this race to have immediately succeeded the Neanderthal man in Europe, since the two present dental characters at the extremes of the range of variation in the Genus *Homo*, so that they would be regarded as good genera zoologically speaking, were it not that the rest of mankind intervenes between them. Bone barbed spear heads of the Inuit pattern have been found in Ohio. The neolithic men of Europe do not differ in cranial or dental characters from the majority of men, so far as they are known. They were not Inuit.

It is well known that Messrs Holmes⁴ and Maguire⁵ have endeavored to prove not only that there was no paleolithic man in North America, but that his existence in Europe is problematical. Paleolithic flints they regard as rejected cores from which fragments have been split for the manufacture of better implements. European authorities do not admit this, but maintain the validity of paleolithic man. The question to my mind is, however, more complex than it was. If the Neanderthal man is the paleolithic man, then he existed beyond a shadow of a doubt. But the river-drift men were totally distinct, probably Inuit. Did any other paleolithic man exist? The chances of proving the existence of such a man in Europe are diminished but not extinguished.

If we turn to North America, the evidence of the existence of any man but the so-called Indian on this continent is insignificant compared with the evidence for primitive man which exists in Europe, but, such as it is, it is important. Paleolithic flints have been found at Little Falls in Minnesota, at Newcomerstown in Ohio, and paleolithic argillites near Trenton, New Jersey, in beds of pliocene age more or less related to glacial conditions. The attempts of Mr. W. H. Holmes to discredit these alleged discoveries does not appear to me to be successful. His criticism of the great manufactory of turtle-backs at Piney Branch near Washington, D. C., which he believes to be the refuse of an arrow

³ Amer. Journal of Morphology, 1888, p. 7.

⁴ Journal of Geology, 1893, p. 147; American Geologist, 1893, p. 219.

⁵ American Anthropologist, 1893, p. 307; American Naturalist, 1895, p. 26.

factory, is worthy of closer attention. In any case, the evidence from glacial deposits of the existence of paleolithic man in America is not yet very considerable.

If we turn to the caves, we have, at least, the opportunity in this country of demonstrating the existence or non-existence of Cave Dwellers. Between 1868 and 1871, I explored the contents of three ossiferous caves; one in Tennessee, one in Virginia, and one in Pennsylvania. No report was made on the contents of the first, as the material was sent to a museum in Philadelphia and was never seen after. Reports⁶ on the other two were published. All of these caves are situated south of the terminal moraine of Lewis and Wright. A report on the contents of Hartman's Cave in Northampton Co., Pennsylvania, within the line of the terminal moraine, was made⁷ by Professor Leidy in 1887. These investigations brought to light the existence of a definite fauna, which I have called the *Megalonyx* fauna, and which is the last of the extinct faunas of North America. It includes the extinct genera of Mammalia, *Platygonus*, *Smilodon*, *Megalonyx*, *Mylodon*, *Mastodon*, and extinct species of *Bos*, *Dicotyles*, *Equus*, *Tapirus*, *Ursus*, *Castor*, *Arvicola* and *Lagomys*. Teeth and other fragments are found which are not distinguishable from the following species now existing in the country; *Cervus virginianus*, *Canis lupus*, *Ursus arctos*, *Vulpes virginianus*, *Procyon lotor*, *Didelphys virginianus*, *Lepus sylvaticus*, *Arctomys monax*, *Castor fiber*. These remains are enclosed in a red calcareous clay, which, when dry, forms a matrix of moderate hardness, similar to that observed in the bone caves of Europe and Asia.

It may be here remarked that the bone caves of the world so far as explored, present us with an oldest fauna of about the same age. They nowhere include fossil remains of animals of an age prior to the Plistocene. This I have had occasion to verify on specimens brought from the caves of Mount Carmel, Syria by Sir William Dawson, as well as on the American material already mentioned, and as has been long since shown with regard to the caves in Europe. And this in spite of the fact that bone caves exist in all limestone formations from the Cambrian upwards, and have doubtless commenced their formation so soon as the respective limestones were sufficiently elevated to be subject to the soluble and erosive effect of water flowing in its fissures. The plain inference is that all those parts of the caves which represent this

⁶ Proceeds. Amer. Philos. Soc., 1869, p. 171. Ibid., 1871, p. 73.

⁷ Annual Report of the Geological Survey of Pennsylvania, 1887, p. 1.

work which was accomplished prior to the Plistocene age with their contents, have been removed by atmospheric and other erosion.

The explorations in American caves conducted by Mr. H. C. Mercer of the University of Pennsylvania in the last two years, have thrown interesting light on the subject. He examined some twenty five caves⁸ and rock shelters situated in the valleys of the Tennessee, Kanawha and Ohio Rivers with great care, digging trenches to bed rock, noting the deposits in their bottoms, and saving all the fragments met with, carefully classified as to position, etc. *In only one of these did he find a slight trace of the Megalonyx fauna*, and in this case only in a stratum at the bottom. In all the others were found the bones of the existing wild fauna of the country, the mammalia, birds, reptiles and fishes, with bones, pottery, and flints of the American Indian. The sole exception mentioned was the Lookout Cave, Tennessee, where in a bed of red clay at the bottom, there were found a jaw of a *Tapirus haysii*, and of a small *Myiodon*. The cave deposits encountered were loose and nowhere indurated as in the caves containing the *Megalonyx* fauna explored by myself. It is perfectly clear from these results that there exist cave deposits of two ages in eastern North America, the one containing the existing fauna and the Indian, and the other containing the *Megalonyx* fauna, *and which has so far yielded no traces of the existence of man.*

What cause exterminated this populous fauna of large and small Mammalia from the North American Continent? Some of its features are distinctly South American. Such are the genera of sloths, *Myiodon*, and by relationship *Megalonyx*, although the genus did not occur in the Southern Continent. Such are the genus *Smilodon*, and the species of peccaries and tapirs, and the great rodent *Castoroides* which probably belongs to the same. The nearest approach to members of this fauna in N. America are the peccary of Texas and the tapir of Mexico. The appearance of the caves of this period throws some light on the question. The Virginian bone breccia which I examined was the floor of a cave only, the cave itself had been carried away by some powerful agency. The Tennessee cave was a steeply descending shaft which had been filled to the mouth. I found it most convenient to break from the roof of a hole which pierced the deposit, the fragments of matrix which contained the bones. The cave at Port Kennedy on the Schuylkill River, Penna., is a fissure, and it is packed from floor to opening with alternating deposits of clay and vegetable

⁸ AMERICAN NATURALIST, 1894, pp. 355, 626.

debris mixed with fragments of limestone and wood. In my opinion all of these caves have been submerged, and their contained deposits are rearranged sediments. The later caves have not been submerged since they received their present contents. The difference in the age of the respective deposits is, then, considerable. In the case of the Lookout Cave, Tennessee, explored by Mr. Mercer, a part of the old cave deposit remained, and was covered by the modern bed.

Geologic history presents us with a submergence at the middle of the Plistocene period, precisely such as constitutes the culminating point of every geologic system. This has been termed by Dana the Champlain epoch, and we may well retain the name in a broadened sense for the continental submergence to which we owe not only the Champlain and Erie formations of the North, but the Columbia gravels of the Middle and Southern States, so thoroughly studied by McGee. That the submergence was not without short reversed movements and oscillations has been shown by Spencer, but that it was continental in extent there can be no doubt. It is also clear that it was followed by an emergence, which constitutes the Terrace epoch of Dana's system. We are then led to the conclusion that the fauna of the Megalonyx epoch is pre-Champlain, and that of the later caves post-Champlain. The country was, however, not probably wholly submerged. Some species, mostly the smaller ones, and the genus *Megalonyx*, survived on the not submerged land, and these we find to be common to the two faunas. The Hartman's cave, within the limit of the ice sheet, is on a hill now elevated 800 feet above the level of the Delaware River. That it was subjected to submergence is shown by the stratified clay with which it is even now partly filled. Its fauna does not include all the types of the *Megalonyx* fauna, and does include the *Castoroides*, as shown by Leidy. It includes a larger proportion of existing species than the usual *Megalonyx* fauna. Its peculiarities are probably due to its northern latitude.

This submergence corresponds with the one which Professor Prestwich insists effected Europe subsequent to the glacial elevation.⁹ The Paleolithic flints of Kent he thinks demonstrate such a submergence, and his reasoning as to the character of the deposits in the European caves applies exactly to the bone breccias of the *Megalonyx* age of our caves here.

The existence of Paleolithic man in North America has not yet been demonstrated by the cave explorations so far as they have gone. We can, however, only consider this conclusion as one which may be re-

⁹ Transac. Royal Soc. London, 1893, p. 903.

versed at any time. The state of affairs on the Pacific Coast may be stated as throwing considerable light on the subject.

The *Equus* beds are found covering areas of various extent in Oregon, Nevada, California, the Staked Plains, Southern Texas, Chihuahua and the valley of Mexico. Their most eastern station is western Nebraska. They contain a fauna which includes one extinct species (*Equus major* Dek.) of the *Megalonyx* fauna, and the recent *Castor fiber*. They contain the extinct genus of sloths *Mylodon*, of a species different from that of the east, and four species of camels of the extinct genus *Holomeniscus*, and a peccary. Recent species of *Canis* and *Thomomys* occur, while two extinct horses (*Equus occidentalis* Leidy and *E. tau* Owen) are common. The hairy elephant (*E. primigenius*) is abundant, while the *Mastodon americanus* is rare, if occurring at all. The proportion of recent to extinct species and genera in the *Equus* bed fauna is very similar to that occurring in the *Megalonyx* fauna, while they differ as to details.¹⁰ This fauna has also disappeared from the continent, a few species, as in the east, surviving to a later date. Was its disappearance due to a submergence as in the east? The appearance of the beds in Texas leads us to suppose that such was the case; while the deposit in Oregon appears to me to be that of a lake now desiccated. The gold-bearing gravel of California, which is also Pliocene, must have been the result of floods, and its wide distribution and stratification resemble conditions due to submergence. Whether the *Equus* fauna was destroyed more or less by submergence or not, the reëlevation of the Sierra Nevada introduced a period of desiccation to the east of it, before which all large mammals remaining must have succumbed.

The remains of man have been shown to occur in the gold-bearing gravels. I have found them (obsidian spear and arrow heads) in profusion mixed with the bones of the extinct fauna at Fossil Lake, Oregon, in a friable and wind-blown formation. This man, however, so far at least as regards California was not Paleolithic, since he made smoothly ground pestles and mortars.

There is, therefore, considerable probability that man was a contemporary of the *Equus* fauna, and the *Equus* fauna was contemporary with the *Megalonyx* fauna of the east.—E. D. COPE.

Paleolithic Man.—*To the Editor of the American Naturalist*:—

Dear Sir:—In the January number of your estimable Journal,

¹⁰ See *American Naturalist*, 1889, p. 160, for a partial list of the species of this fauna.

there appeared on page 28, the following statement: “* * in America the friends of paleolithic man have with few exceptions deserted the proposition as an unsupportable theory.”

Without raising any discussion upon the theory of the paleolithic age in America, I desire to enter my protest against the correctness of the foregoing conclusion.

There may be those who believe the existence of a paleolithic period in America is not yet proved; who only believe in its probability and do not reject the evidence cited in its favor; but of all those thus classed, I know of none who “have *deserted the proposition as an unsupportable theory.*”

Respectfully,

THOMAS WILSON.

The Smithsonian Institution, Washington, Jan. 30th, 1895.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History.—April 17th.—The following paper was read: Prof. William Libbey, Jr., “Two Months in Greenland;” stereopticon views were shown.

May 1st.—The reports of the Curator, Secretary, Librarian, Treasurer and Trustees were read, also the report of the Walker Prize Committee. The election of officers for 1895–96 was held. The following paper was read: Mr. J. L. Tilton, “On the Geology of the Southwestern Part of the Boston Basin.”

May 15th.—The following papers were read: Prof. Thomas Dwight, “Notes on the Dissection of a Chimpanzee, with Especial Reference to the Brain.” Prof. N. S. Shaler, “The Conditions of Escape of Gases from the Interior of the Earth.”—SAMUEL HENSHAW, *Secretary*.

Academy of Science of St. Louis.—April 15th.—Miss Mary E. Murtfeldt presented a paper on “The Habits of Certain Seed-Feeding Insects.”—A. W. DOUGLAS, *Recording Secretary*.

American Philosophical Society.—April 19th.—Dr. D. G. Brinton read a paper on the “Proto-historic Ethnography of Western Asia.”